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ABSTRACT

Factors influencing the achievement and retention of ethnic minority students were studied, focusing on 38 ethnic minority students in a college engineering program. Of the 38 students, 12 were African American, and 26 were Hispanic of Mexican American origin. Students were participants in the university's Equal Opportunity in Engineering program, which targeted its retention efforts to ethnic minorities. Information on their achievement in the first and second semesters was compiled, and a profile was created for each student, using grade point average and retention status to create achievement and retention (in engineering) categories. Telephone interviews were conducted with students to determine their perceptions of factors that influenced their achievement and retention. Successful students were more articulate about their use of study strategies and seemed to have more metacognitive awareness. Successful students listed group studying as one of their primary learning strategies. Both successful and unsuccessful students made negative comments about the teaching ability of some teachers, but successful students were able to identify ways to circumvent negative instruction. (Contains 27 references.) (SLD)

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MINORITY STUDENTS WHO PERSIST: A THREE-YEAR STUDY OF UNDERGRADUATE ENGINEERING MAJORS

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MINORITY STUDENTS WHO PERSIST: A THREE-YEAR STUDY OF UNDERGRADUATE ENGINEERING MAJORS

Ethnic Minorities in Higher Education

Affirmative action and active minority recruitment in the late sixties and early seventies were responsible for dramatic increases in African American and Hispanic student enrollment in public colleges and universities. By 1979, African American high school graduates were entering college at about the same rate as their white peers (Mingle, 1980). From 1986 to 1988, minority enrollment in the nation's colleges and universities increased 7.2 percent. Despite these gains, Hispanics and African Americans made little progress in achieving parity with whites in college participation during the latter half of the 1980's. In 1989, 28.7 percent of Hispanics and 30.8 percent of African Americans of college age were enrolled in college, in contrast to 38.8 percent of whites (Carter & Wison, 1990).

In addition to this disparity in enrollment rates, the retention of African American and Hispanic students in higher education has emerged as a still more difficult task than simply increasing ethnic minority freshman admissions (Cross & Astin, 1981). African American students in white institutions tend to have higher attrition rates, lower grade point averages, and lower enrollments in post-graduate programs than whites in the same institutions (Allen, 1981; Suen, 1983; Lunneborg & Lunneborg, 1985). Hispanic high school graduates in 1989 had a college enrollment rate of 28.7 percent, compared with 38.8 percent for whites. The situation for students of Hispanic origin is even bleaker, given that demographics show them to be the fastest growing ethnic minority group in the United States.

Efforts to reduce disparities between ethnic minorities and whites in retention rates have had limited success. In 1987-1988, African American and Hispanic students were taking longer to complete their academic studies and dropping out of college at higher overall rates than white students (Saldana, 1990). Such statistics are especially disheartening when one considers the rapid development of formal and informal support systems, such as retention programs, for ethnic minority students on college campuses.

Retention programs designed for ethnic minority students seek to ease the transition from high school to university life. These programs vary in what they offer ethnic minority students among them; financial assistance, mentoring programs, seminars and orientation programs, counseling and mental health services, and the establishment of ethnic minority organizations and cultural service centers. A recent report by the Texas A&M Research Foundation (1990) has found evidence that some support programs do appear to exert a large and statistically significant effect on African American and Hispanic academic achievement.

The Influence of the Instructor on College Retention

One of the most important variables that affect student achievement in a given class, is the teacher. A number of studies have focused on the effects of teacher variables on student achievement, however fewer have focused on instructional effects upon minority student retention. Brophy (1986) has pointed

out that efforts to improve retention rates for at-risk minority students must be grounded in efforts to improve instruction at the college level. Levin & Levin (1991) have also stated that retention programs should incorporate known-to-be-effective instructional components. Student persistence research (e.g., Pacarella & Terenzina, 1980; Tinto, 1985) has shown that faculty-student interaction and mentoring of minorities are two very important processes related to retention. An ethnographic study by Craft (1991) of minority students enrolled at a university, did find that students, in general, perceive interactions with professors as influencing their achievement. Despite these suggestions, we know little about the effect that an instructor's teaching ability may have on minority student retention.

Learning Strategies and College Retention

Achievement and persistence on academic tasks has been studied using a variety of cognitive theories. Researchers such as Weinstein and Mayer (1986) and McKeachie, Pintrich, Lin and Smith (1986) have examined the effects of learning strategies upon student academic success. Motivational theories such as; attributions (Weiner, 1985), attributional style (Peterson & Seligman, 1984), expectancy-value motivation (Eccles, 1983), and mastery/performance goals (Dweck & Elliot, 1983) have focused on cognitive-affective influences upon academic achievement. Still other researchers such as Tinto (1988) and Kraft (1991) have emphasized the role of social variables such as institutional commitment and teacher involvement and their effect upon college retention.

Presently, there is a shocking scarcity of research on cognitive, motivational and social factors which specifically affect minority retention at the college level. Most research on ethnic minority achievement and persistence at the college level has focused on particular attributions of these groups, when compared to white subjects, following success or failure at achievement tasks (Friend & Neale, 1972; Graham, 1984). In addition, cognitive constructs previously used with white students have been applied to ethnic minority students and these results are compared to those found from that research on white students (e.g., Bar-Tal, 1982; Friend & Neale, 1972; Graham & Long, 1984; Maehr & Nicholls, 1980). Hui and Triandis (1989), cross-cultural psychologists, have noted that attributions for causality for success and failure vary from culture to culture as well as from person to person. They suggest that cognitive-motivational dynamics may function differently in individuals from ethnic minority groups. In addition, Ogbu (1981) points out the limited value in studying one cultural group, developing an explanatory theory and then applying it in another cultural group.

Our concern is then, if we are to more precisely assess the factors which affect academic achievement and persistence of minority students, we need additional information on how *they* perceive their academic experience. Particularly, what factors play a part in retention or attrition of minority students over time. The objective of cross-cultural research is to understand and to explain differences in cultural attitudes and behaviors- not simply to document differences. We already know that there are differences between cultures- what is of interest are the underlying *processes* which mediate these differences- and what is of particular

interest to the educator is *how*. motivational and achievement factors interact, given individual differences in a student.

METHOD

Subjects

Subjects were 38 ethnic minority college students who enrolled in a college engineering program at a large, southwestern university in the fall semester of 1990. At the beginning of the semester, all freshman Hispanic and African American students had been assigned to one of 26 different peer counseling groups. These groups were established as part of the university's Equal Opportunity in Engineering program, which targeted it's retention efforts at these two groups. For the purposes of this study, four peer counseling groups, each which consisted of nine or ten ethnic minority freshmen, were selected. Seven of the subjects were women, thirty-one of them male. This ratio represents the male-female distribution enrolled in engineering at this institution as a whole. Of the thirty-eight subjects, twelve were African American, twenty-six were Hispanic of Mexican-American origin. This ratio represents a slightly larger percentage of African American students than exists in the university engineering program as a whole.

Program Description

Beginning in the spring of 1990, coordinators and counselors working with the Equal Opportunities in Engineering (EOE) program were interviewed about the programs they provided to ethnic minority students in the college. The EOE office was established with the goal of achieving a student body in the College of Engineering which represented the ethnic distribution of the college-age population within the state. The office, in an effort to achieve this goal, directs a vigorous recruitment program, maintains strong minority student organizations, garners healthy financial support from industrial contributions, and coordinates a program to minimize attrition during the first two years of college.

The EOE program consists of several sub-programs specifically aimed at minority retention: a freshman orientation program; a faculty mentor program; engineering, math and science tutorials; academic counseling; peer counseling; and two student engineering organizations. Input from the program coordinators was solicited to determine which part of the program might the most appropriate vehicle by which to investigate the experience of incoming freshman engineers. The coordinators of the EOE program emphasized the importance of peer support groups in deterring attrition of students. This collaborates with current studies which cite the degree of academic and social integration as predictive of retention (e.g., Tinto, 1988; Tracey & Sedlacek, 1987).

The Engineering Peer Support (EPS) program was thus selected as a method by which both students and their peer counselors might be solicited for information on how students negotiated their way through the engineering program. The academic counselor, who coordinated these groups, agreed to provide the investigators with additional information about issues involving students with academic difficulties and students who chose to leave the engineering program.

Procedure

In the fall of 1990, the investigators attended orientation meetings, faculty mentor meetings, receptions, a peer training session, and a peer support orientation for freshmen engineers. Peer counselors were solicited for participation in the study. During the peer support orientation, a background questionnaire was passed out to all students. The purpose of this study was explained to those attending and volunteers were solicited.

During the third week of the semester, when all ethnic minority engineers had been assigned to a peer support group through EPS, four peer groups were selected with the consent of their respective peer counselors and with the cooperation of the academic counselor. Subjects in the four peer counseling groups were then contacted and invited to participate in a longitudinal study of student use of minority support programs.

During the first semester, each peer counselor was contacted twice about the number of times the group had met, the number of students attending the peer group, and the overall adjustment of the students in their study groups. Questionnaires were distributed by the peer counselors mid-semester to question the students in the groups about their use of other services available to them through EOE.

At the end of the first semester, all thirty-eight subjects were interviewed by telephone about their use of EOE services and their academic experiences of their first semester. The general question of the investigators was, "What are the factors which influence retention of ethnic minorities in this college of engineering?" A more specific question was: "What services and strategies do these students use and why?" Using previous studies on academic achievement (Ames & Archer, 1988; McKeachie, et al., 1986; Perry & Penner, 1990) and input from the academic counselor and EOE coordinators, a list of questions was developed (See appendix A). Students were asked to refer to one of their introductory science or math courses when responding to the questions to provide a more specific context for their responses. While these questions were meant to guide each interview, the subjects were encouraged to, and often did, make additional comments about their experiences and these comments were also recorded.

Additional information was gathered on each student from the background questionnaires that they filled out at the beginning of the semester, and, at the beginning of the spring, 1991 semester, their grades and grade point averages were obtained from the EOE office. In addition, records of their attendance at EPS groups and tutorials were obtained from the peer counselors and tutorial record sheets. This information was added to the information obtained from the telephone interviews.

Responses to questions were examined across each student profile and summarized as a group. Descriptive statistics of the first eight questions were examined and correlated with final grades in the targeted course and the overall G.P.A. of the student. Differences between responses obtained from the two ethnic minority groups were noted. Emerging patterns in the data were discussed in frequent meetings with the coordinators of the EOE program and with the academic counselor.

Based upon the initial analysis of the data, questions pertaining to grade satisfaction, effects of the first semester experience on their approach to the course in the current semester, high school preparation in math and physics, and number of students they knew on campus were added to the interview in the second semester (See Appendix B). Students who had decided to leave the engineering program or were contemplating leaving the program were asked for their reasons for doing so. Grades for each students were obtained at the end of the second semester, along with their G.P.A.s.

Information from both the first and the second semesters were compiled and profiles of each student were composed. The students were categorized into one of three groups; "high achievers," "low achievers" and "departures from the program." "High achieving" students were defined as those students who had remained in the program, had maintained at least an overall 2.0 G.P.A., and had at least a 2.0 G.P.A. the second semester. The 2.0 G.P.A. cutoff was used since students with grade point averages falling below this level were placed on academic probation by the university, and, after two semesters on academic probation were subject to dismissal. "Low achieving" students were determined to be those who had not maintained these averages, but who remained in the program. "Departures" were students who had chosen to leave the program. It was found that at the end of the first year, all students who had left, or who were planning to leave the program had done so to pursue new academic goals. None had left because of academic dismissal. However, 14 of the students still remaining in the program had G. P. A.s below a 2.0 at the end of their first year.

Categorization of the sample into the three categories was done independently by the two investigators. These categories were then compared for their reliability. The investigators noted emerging themes from the interview data. The themes of the three categories were then discussed with the coordinators and the academic counselor of the EOE program. Based on suggestions from the EOE personnel and from initial analysis of the first year data, questions from the first year interviews were modified to include the following: the amount of time the student spent studying in groups versus alone, the kinds of academic help they sought, any interaction with faculty, and how well they felt they "fit in" with the engineering program (see Appendix C). At the end of the third semester, all subjects were again interviewed by phone. Again, semester grades for each course and an overall G.P.A. were obtained for each student.

Summary profiles of each student were once again compiled, this time using the data from the three rounds of interviews. Two variable, G.P.A. and retention status were then used to create four categories of students: high achievers, low achievers, high achievers departed from engineering, and low achievers departed from engineering. A cumulative G.P.A. and fall semester G.P.A. of 2.0 was used to create the high versus low achiever groups. A few of the "low achievers departed from engineering" began academic suspension in the spring semester of 1992.

As a result of an analysis of the themes (see Analysis section below) from the data collected during the first three semester of this study, __ students were contacted for a phone interview during the fall semester of 1992 and the spring semester of 1993 (see Appendix D). These students were asked, once again, about

their perceptions about their academic performance, the things that had helped them stay in the engineering program, and the role that their ethnicity played in their academic experience. In addition, as part of a confirmatory analysis, these students were asked to comment on the themes that had emerged thus far in the analysis of the data.

This paper focuses on the qualitative analysis of those students who, after three years in the engineering program, we have categorized as being "successful," in that they have remained in the engineering program and have maintained at least a 2.0 cumulative G.P.A.

Analysis

Using Glaser and Strauss' (1967) constant comparison method, emergent themes from each group of students were analyzed after the third round of interviews. Themes of particular interest to the investigators, who have a cognitive/motivational orientation, were those associated with academic achievement. These themes were labeled and described independently by the two researchers. These themes and their descriptions were then cross-verified by the investigators together and relabeled and defined. Each investigator examined the third semester profiles, the first year profiles and the original transcripts for separate verification of the presence of each emerging theme. Original transcripts of the answers to the interview questions were extracted as supportive evidence for the existence of each theme. The investigators together combined findings from the separate analyses to produce a final description of each theme, along with the properties and dimensions of them.

During the last year of this study, a sub-sample of the subjects were interviewed. These subjects were asked to give their reflections on the themes that the investigators had identified after the second year of the study. Interviews from those students who had been labeled as "successful" were used to reexamine these themes. The findings from the successful students, for the purposes of this paper, will be discussed in relationship to two themes, those of *learning strategies* and *teaching ability of professor*.

Learning Strategies

Included in the "learning strategies" category were comments about when and how to "read the book;" "working problems" as an important approach to learning the material; type of and effectiveness of "help from others;" and "spending more time studying." For example, when asked "What helped you the most in understanding this course?" and "What would you do differently if you were to start this course over again?" typical student responses were: "Take notes out of the book before attending class," "work more problems," "study ahead of time, at least a week before exams," try to study every day," and "studying with others got me through the semester." For this paper, learning strategies that were described by successful students were analyzed.

Teaching Ability of Professor

Responses to the interview evoked another genre of comments which we labeled "teaching ability of the professor." Included in this second category were students' attributions for success and failure which focused on the professor, the professor's contribution to achievement, and visits to professors during office hours. Two types of remarks were part of this overall category" "good professor" and "bad professor" remarks. For example, "good professor" responses were descriptions of office visits where the professor was available and helpful, and lectures were clearly given and prepared the student for exams. Most common among the "bad professor" responses were statements such as, "the teacher was not there to teach," "not into teaching," or "not really teaching." Subjects gave examples of professors who got angry at them, talked down to them, or did not clearly explain course material. Words such as "disappointed" and "discouraged" were sued to describe their perceptions about the professor. Several students said that they would pick another professor if they could have. Other students reported that they did not pay attention in class or even quit attending class because of the poor quality of the professor's lectures. In the following section, those comments from successful students in the engineering program will be analyzed.

Results

At the end of the second year of this study, of the total sample of 28 students, 18 had been categorized as being "successful" (having over a 2.0 G.P.A. the fourth semester and over 2.0 cumulative G.P.A.). This categorization of students as "successful" or "unsuccessful" had not changed over a period of two semesters during the second year of this study. Data is currently being collected on students' achievement for the fall semester of the third year of this study.

Learning Strategies

Successful student more frequently described specific learning strategies that they used, and offered more details about what they would do to improve their grades and why. For instance, in the third semester of this study, 72% of the successful students said that reading the book helped the most, and only a third of the low achievers commented on how they used their text. Successful students also mentioned when or how they would read, whereas the low achievers and drop-outs did not.

A similar phenomenon was seen in comments about "working problems" and "studying more." Half of the successful students said that working problems helped them the most. Low achievers referred to working homework problems but not to working problems in addition to those that were assigned. The successful students, on the other hand, talked about working extra or supplemental problems, not just homework problems, and specified where they found these problems: study guides, old tests, worksheets from professors or other help sessions.

Most of the students mentioned seeking some type of help from others. Study groups and EMS classes (Engineering Math/Science supplemental instruction) were the most frequently mentioned, followed by tutors, student assistants available at "homework tables" in one of the departments, the university

learning skills center, TA's and professors' office hours. However, when successful students described getting help from others they often referred to working in groups with "friends." This result was confirmed during the third year of this study when we asked, "What has helped keep you in the engineering program?" Most of the successful students commented that study groups they had joined had had a significant and positive effect on their remaining in the program.

Teaching Ability of the Professor

Comment in this category were divided clearly between those about "good professors" and those about "bad professors." "Good professor" comments were noted by both successful and unsuccessful students.

At the end of the second year, virtually all of the low achievers had referred to poor teaching, usually in response to questions about factors which hindered their achievement. These comments included those such as, "The professor wasn't capable of breading down problems to the students' level," and "I wasn't picking up much from the professor at first so I stopped going to class." However, the low achievers were not alone in their evaluations of teaching performance. By the end of the second year of this study, close to half of the successful students also had mentioned poor teaching as having affected their achievement.

When we interviewed the students during the third year, we asked them, "Some students have commented about the teaching ability of their professors and the effect their teaching ability has had upon their academic success or failure at the university. What are your views on this?" Successful students, as did unsuccessful students, verified that they often found the teaching ability of their professors lacking. A difference between the groups, however, was that the successful students reported varied and detailed examples of how they coped with "bad teachers." They were specific with regard to the kinds of support services and resources they sought out to compensate for the lack of information they received in class.

Discussion

The results from this qualitative study suggest several influences on ethnic minority students' achievement and retention. While the limited size and the homogeneity of this sample admittedly restrict the generalizability of this study, there are several themes in our interviews with students that deserve closer scrutiny.

Learning Strategies

One such area for further investigation, relative to learning strategies, is suggested by the fact that successful students were more articulate about their use of study strategies. While it might be the case that successful students are simply better at verbalizing how they study, rather than better at studying, we believe that the successful students actually differed from unsuccessful students with regard to their strategy use. Successful students also expressed more of what some researchers (e.g., McKeachie, 1986; Mayer, 1988; Weinstein & Mayer, 1986) have referred to as *metacognitive awareness*, in that they were aware of when and where the application of these strategies positively affected achievement. We would like to

suggest that unsuccessful students might have benefited from training in metacognitive learning strategies. Levin and Levin (1991) have pointed out that one of the most effective methods in which learning strategies might be integrated into a retention program is through instructors themselves, within the context of courses in which the students are already enrolled.

Our finding that the successful students referred to group activities or studying with friends as an effective study technique coincides with evidence that active learners are more likely, rather than less likely to seek help when it is needed (Karabenick & Knapp, 1991). That the successful students listed group studying as one of their primary learning strategies is also of interest. Uri Treisman's extremely successful Math/Science Workshop Program for ethnic minority students at the University of California at Berkeley uses groups as the primary method by which to affect student achievement.

Teaching Ability of the Professor

Both the successful and unsuccessful students made negative comments about the teaching ability of their teachers. However, the successful students also were able to identify ways in which to circumvent negative instruction. They spoke specifically about a variety strategies such as, "Getting another book," or "Working problems before attending class." Several researchers (Linder & Harris, 1992; Weinstein, Zimmerman, & Palmer; Zimmerman 1990) have pointed out that college students who are successful exhibit greater flexibility in adapting to the demands that exist in the classroom. We believe that the successful students, while they were affected by the teaching ability of their professors, were able to cope with the situation and knew ways in which to learn the required material despite perceived bad instruction.

Conclusions

This study, in an effort to extend the literature on factors that affect achievement of students from ethnic minority groups, focused on the perceptions of students from an engineering program. Our goal was to understand the successful student's view of influences upon their academic success. Admittedly, we adapted a traditionalist view of "academic success" in these groups, as well as what connoted "academic behaviors." Ogbu (1981) points out that academic behaviors represent white middle-class cultural ways whose racial policies and might be perceived as preventing ethnic minorities from the attainment of desired goals. Ethnic minorities may not be always oriented toward abandoning or substantially modifying rules of behavior for achievement in favor of adapting those of the white middle class. However, it was our intention to focus on how traditional constructs of motivation and cognition interacted in these students' academic experiences. This study suggests that those students who articulated a wider variety of learning strategies, including the extensive use of study groups, who were more metacognitively aware of strategies they had at their disposal, and who, despite "bad professors," were able to seek out course information from a variety of sources, were ultimately more successful.

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